HARTS

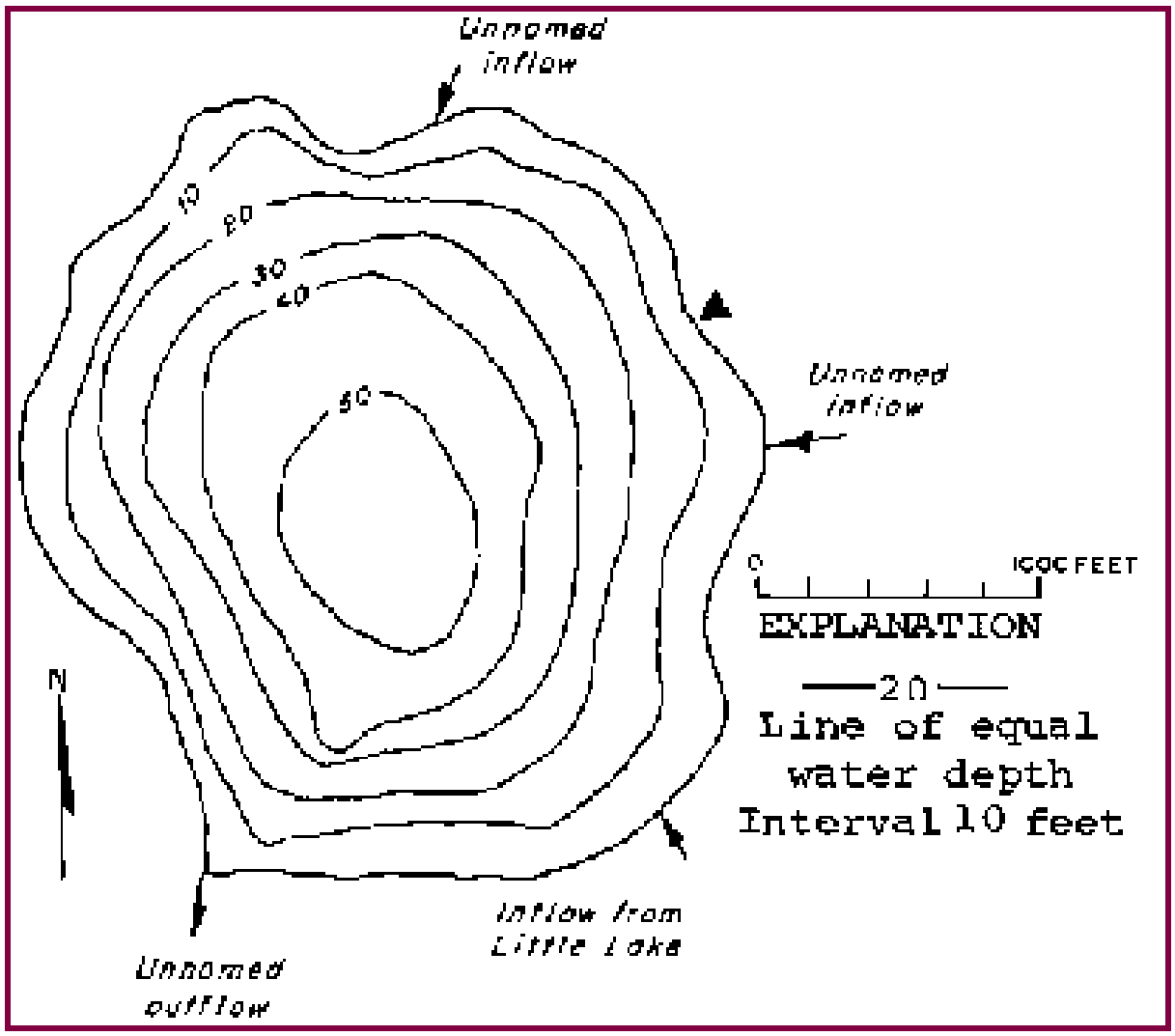
PIERCE County

Lake ID: *HARPI1*

Ecoregion: 2

Harts Lake is located approximately seven miles southeast of Yelm, just east of the Pierce County line. It is fed by an inflow from Little Lake, to its south, in addition to two other unnamed tributaries. It drains via an unnamed outflow to the Nisqually River. It tends to experience dense summer algal blooms.

Area (acres)	*Maximum Depth (ft)*	*Mean Depth (ft)*	*Drainage (sq mi)*	
120	50	26	4	
Volume (ac-ft)	***Shoreline (miles)***	***Altitude (ft abv msl)***	***Latitude***	***Longitude***
3100	1.61	347	46 53 32.	122 28 18.



Station Information

HARPI1

Primary Station Station # 1 latitude: 46 53 39.3 longitude: 122 28 01.3

Description: Deep part of lake, in approximate middle of round lake.

Trophic State Assessment for 1999

HARTS

Analyst: Sarah O'Neal

TSI_Secchi:	[a]	51
TSI_Phos:		65
TSI_Chl:		62
Narrative TSI:	[b]	E

Harts Lake is a small, fairly deep lake. While it may be naturally eutrophic, nutrient levels in 1999 were alarmingly high, and appeared to be limiting beneficial uses of the lake more than any other lake studied intensively in 1999. Internal loading, in which nutrients are released from the sediment into the water column, contributed significantly to phosphorus levels in the lake. Severe anoxia in water deeper than 3-4 meters for much of the summer occurred with the "rotten-egg" smell generated by hydrogen sulfide, and lead to internal nutrient loading. There were few homes around Harts Lake, and the shoreline was estimated to be eight percent naturally vegetated. However, a very large dairy and egg operation bordered the south inlet stream which artificially accelerated the eutrophication of the lake, according to a 1983 Ecology study. Additionally, a hog farm bordered the north inlet stream, and likely also contributed to nutrient levels. The lake occasionally smelled of manure. Macrophytes and algae grew densely, likely as a result of high nutrient levels. The non-native, aggressive plant, Eurasian watermilfoil (Myriophyllum spicatum), was present, though not in abundance. Water lilies dominated the plant community, encircling the lake in a wide band. Algae bloomed exceptionally densely throughout the summer, however water clarity was relatively good for an eutrophic lake. This may be have been due to the relatively large size of the algae colonies.

The vast majority of questionnaire respondents used the lake for fishing, while a few watched wildlife and relaxed. Primary contact recreation was not popular, likely due to water quality and aesthetics, which most respondents believed had worsened in the 1990s. Many respondents requested WDFW stock higher densities of trout in the lake. However, the anoxic conditions in the hypolimnion and warm summer surface temperatures probably limited trout survival. The zooplankton community decreased in average size over the course of the summer indicating utilization by planktivores and possibly inadequate numbers of piscivores. According to a 1999 WDFW survey, Harts lake was managed as a mixed species lake, and received hatchery trout and channel catfish to support a put-and-take fishery. WDFW considered the warm water fish community of Harts Lake balanced. Yellow perch were the most abundant fish in the lake, though it also contained significant amounts of brown bullhead, black crappie, and largemouth bass. Channel catfish, pumpkinseed, and rainbow trout were also present at lower densities. WDFW sampled a single cutthroat trout in 1999. It is not known if this was a native or a hatchery fish.

The current extreme eutrophic state of the lake limited coldwater fishing and primary contact recreation. Nutrient levels were, we believe, higher than they should be. Further study is required to determine appropriate total phosphorus concentrations. Pending a more thorough investigation, we recommend a tentative total phosphorus criterion for the lake be set at the current concentration of 87.0 ug/L (mean 67.3 ug/L plus standard deviation of 19.7 ug/L). Future studies will likely recommend lowering this criterion.

Mean Secchi = 1.9m; Mean TP = 67.3 ug/L; Mean Chl = 25.7 ug/L

[a] TSI Qualifiers: B or W-Secchi Disk hit bottow or entered weeds; J-Estimate; N-Fewer than the required number of samples

[b] E=eutrophic, ME=mesoeutrophic, M=mesotrophic, OM=oligomesotrophic, O=oligotrophic

Chemistry Data

HARTS

Date	Time	Strata	Tot P (ug/L	Tot N (mg/L)	TN:TP	Chloro-phyll (ug/L)	Fecal Col. Bacteria (#/100mL)	Hardness (mg/L)	Calcium (ug/L)	Turbidity (NTU)
Station 0										
6/1/1999		L					1 U			
		L					1 U			
9/6/1999		L					25 U			
		L					50			
Station 1										
6/1/1999		E	93.8	1.14	12	29		63.6	12300	2.6
		H	306							
7/10/1999		E	54.7	1.15	21	33.5				
		H	1000	1.5	2					
8/2/1999		E	57.7	1.19	21	43.3				
		H	453	1.09	2					
9/6/1999		E	62.1	.772	12	10.2				1.4
		H	795	1.33	2					

Strata: L=lake surface, E=epilimnion, H=hypolimnion; Qualifier: J=Estimate, U=Less than, G=Greater than.

Watershed Survey

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Survey Date: 9/6/1999

Land Uses (1 = Primary, 2 = Secondary, etc.)

1	**Agriculture(commercial, not hobby)**	2	**Residential**
	Commercial, Industrial	3	**Park, forest or natural**
	Major transportation		

Impervious surfaces (Roads and parking area): No Curbs

Observations (check mark denotes presence)

BMP's ☐

Nice buffers along lakeshore. Approximately 4 homes w/no buffers.

Odors ☑

Earlier this year manure odors detected

Cattle ☑ **Ducks** ☐ **Geese** ☐

There is a hog farm along the north inlet stream and a large heavily populated cattle pasture along the southern inlet stream.

Fertilizers and weed killers appear to be used in residential or agriculture area ☐

None observed

Buffer zones around streams and wetlands ☐

Buffer zones noted near the lake but not along north inlet stream near the hog farm. Although not observed, it is suspected that buffer zones are lacking along cattle pasture.

Irrigation ☐

None observed

Survey Id: 70

Habitat Survey Summary Report

HARTS

Data are averages of ***10*** **Stations Surveyed** **Date of Visit:** 6/24/1999

Vegetation Type (Avg. only of sites w/ vegetation present; 1=coniferous, 3=deciduous)

Canopy Layer Avg:	2.8	**Number of stations with canopy:**	10
Understory Avg:	3.0	**Number of stations with understory:**	9

Percent Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

Canopy Layer:	**trees > 0.3 m DBH**	1.4
	trees< 0.3 m DBH	1.7
Understory:	**woody shrubs saplings**	1.9
	tall herbs, forbs grasses	1.5
Ground Cover:	**woody shrubs seedlings**	2.4
	herbs, forbs, grasses	3.2
	standing water or inundated veg	0.1
	barren or buildings	0.2
Substrate Type (within shoreline plot):	**bedrock**	0.0
	boulders	0.0
	cobble/gravel	0.0
	loose sand	0.0
	other fine soil/sediment	0.0

	vegetated	4.0
	other	0.0
Bank Features:	**angle (O:<30; 1: 30-75; 2:nr vertical)**	0.4
	vertical dist (M from wtrln to high wt):	0.0
	horiz. dist. (M from wtrln to high wt):	0.0

Human Influence (0 = absent, 1 = adjacent to or behind plot, 2 = present within plot)

buildings	0.5
commercial	0.0
park facilities	0.0
docks/boats	0.5
walls, dikes, or revetments	0.0
litter, trash dump, or landfill	0.0
roads or railroad	0.0
row crops	0.0
pasture or hayfield	0.4
orchard	0.0
lawn	0.7
other	0.0

Physical Habitat Characteristics

station depth (m; at 10 m from shore)	1.4

Bottom Substrate (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

bedrock	0.0
boulders	0.0
cobble	0.0
gravel	0.1
sand	0.1
silt	3.9
woody debris	0.5

Macrophyte Areal Coverage (0 = absent, 1 = <10%, 2 = 10-40%, 3 = 40-75%, 4 = >75%)

submergent	1.7
emergent	1.4
floating	3.3
total weed cover	3.7
Do macrophytes extend lakeward (-1 = yes, 0 = no)	-1.0

Fish Cover (0 = absent, 1 = Present but sparse, 2 = moderate to heavy)

aquatic weeds	2.0
snags	0.0
brush or woody debris	0.9
inundated live trees	0.0

overhanging vegetation	1.2
rock ledges or sharp dropoffs	0.0
boulders	0.0
human structures	0.1

Questionnaire

HARTS

Results compiled from 16 **Surveys.** **Average time (years) respondents spent on lake:** 13.60

Did the following add (+1), detract (-1), or have no effect (0) on your enjoyment of the lake today?

Types of WaterCraft:	0.5	View:	0.8	Distance to Lake:	0.2
Public Access:	0.8	Swim Beach:	-0.5	Canada Geese:	0.4
Water Clarity:	-0.7	Water Qual. for Swim:	-0.8		
Fishing Quality:	0.2	Aquatic Plants:	-0.1		

On a scale of 1 (poor) to 5 (excellent), how would you rate water quality today? **2.3**

Which would you rather have, 1 or 2?

1) Better fishing and more natural habitat, or 2) clearer water?	1.3
1) Better fishing and more natural habitat, or 2) fewer aquatic plants?	1.3
1) Clearer water, or 2) fewer aquatic plants?	1.2

How important is each of the following characteristics to you (1 = very undesirable, 5= very desirable):

Restricted Watercraft:	4.0	Good Warmwtr Fishing:	4.4	Natural Scenery:	4.5
Plant Growth:	3.1	Good Swimming:	2.8	Public Beach:	3.3
Natural Shoreline:	4.6	Less Algae:	4.1	Canada Geese:	3.5
No Odors:	4.4	Public Access:	4.3		
Good Coldwtr Fishing:	4.3	Clear Water:	4.5		

Tabulated Results

Survey ID	Date	Residency	Rent or Own	Primary Activity*	Water Clarity: Purchase Factor?	Water Clarity: Has it Changed?	When?
93	8/26/1999	Visitor		10	☐	Unknown	
95	8/23/1999	Visitor		2	☐	Better	
	Please patrol the public fishing area for fishing and trespassing violations.						
105	9/7/1999	Visitor		2	☐	Worse	1995
111	9/6/1999	Visitor		2	☐	Worse	1987
113	8/14/1999	Resident	Permanent	Rent 2	☐	Worse	1994
114	9/13/1999	Visitor		2	☐	Worse	
123	8/10/1999	Visitor		2	☐	Worse	1995
126	8/10/1999	Resident	Permanent	Rent 7	☐	Worse	1998
	Get rid of that darn milfoil!!						
127	8/10/1999	Resident	Permanent	Rent 7	☐	Better	
128	8/10/1999	Resident	Permanent	Rent 2	☐	Worse	1970
131	8/2/1999	Visitor		2	☐	Unknown	
	Stock more channel catfish and walleye						

141	7/10/1999	Visitor			2	☐	Worse	1998
	Stock more trout							
169	7/7/1999	Resident	Permanent	Rent	2	☐	Worse	1997
	Plant more trout							
170	6/30/1999	Resident	Permanent	Rent	7	☐	Worse	1999
	Too many night parties and garbage from overnighters							

* 1=canoe/kayak, 2=fish, 3=pers. wtrcrft, 4=mtrboat, 5=sail, 6=swim/wade, 7=watch wldlf, 8=ski, 9=windsurf, 10=relaxing

Zooplankton Report

HARPI1

Date 6/1/1999 Station: 1 Sample ID 72

Less than .5mL measured. A few rotifers. Extremely dense, dark algae, almost impossible to ID.

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	1.11

Date 8/2/1999 Station: 1 Sample ID 48

About 1 1/3 mL measured. Dense algae made ID difficult.

Number of organisms measured: #Delet

Group	Percent	Group	Percent
Cladocera	#Deleted	Small < 1mm	#Deleted
Copepod	#Deleted	Large >= 1mm	#Deleted
Other	#Deleted	Ratio of large to Smal	#Num!
		Average size (mm):	0.86

Aquatic Plant Data

HARTS

Sampler: Parsons, O'Neal

Survey Date: 6/24/1999

Max depth of growth (M): 3

Comments Cloudy, breeze. Did habitat survey. Water with lots of algae. Many people fishing. Lilies ring lake to ~1.5 - 2m deep. Started raining. Only found a couple of M. spicatum plants.

SPECIES LIST

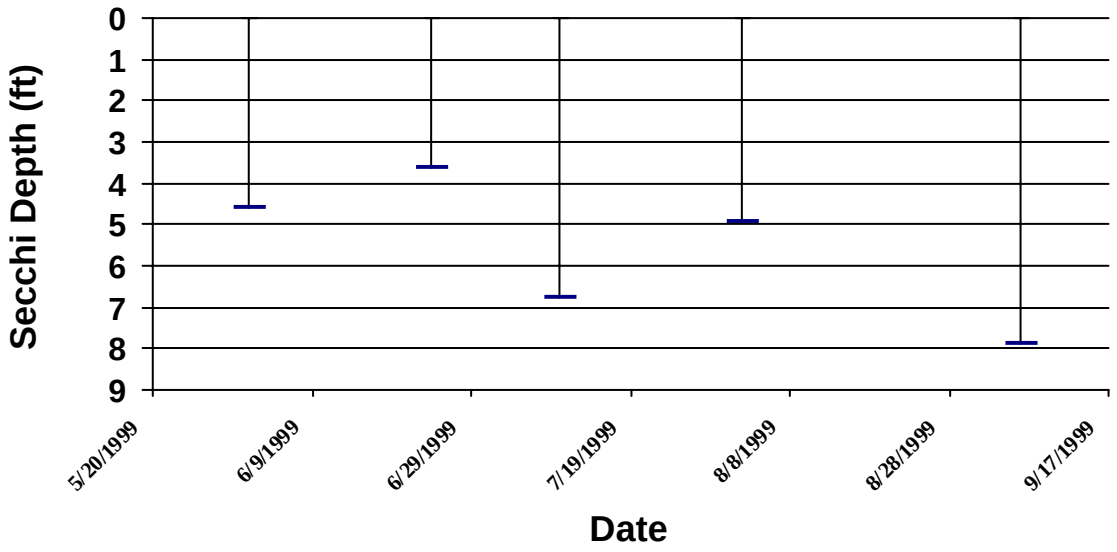
Scientific Name	Common Name	Dist [a]	Comments
Ceratophyllum demersum	Coontail; hornwort	3	most common submersed plant
Elodea canadensis	common elodea	1	
Iris pseudacorus	yellow flag	1	
Myriophyllum spicatum	Eurasian water-milfoil	1	by dock south of launch
Nuphar polysepala	spatter-dock, yellow water-lily	2	patches around lake
Nymphaea odorata	fragrant waterlily	4	rings lake
Potamogeton amplifolius	large-leaf pondweed	1	
Potamogeton crispus	curly leaf pondweed	1	
Potamogeton illinoensis	Illinois pondweed	1	
Potamogeton pectinatus	sago pondweed	1	

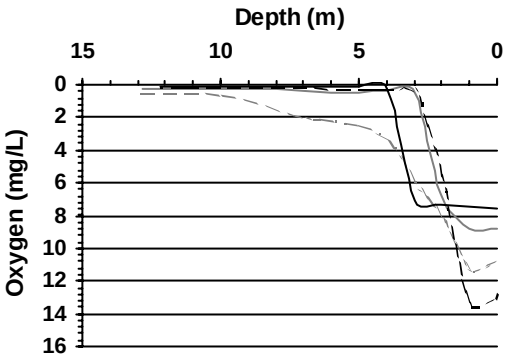
Potamogeton sp (thin leaved)	thin leaved pondweed	2	
Scirpus sp.	bulrush	1	bulrush
Solanum sp.	nightshade	1	
Typha sp.	cat-tail	2	
Vallisneria americana	water celery	1	fragment

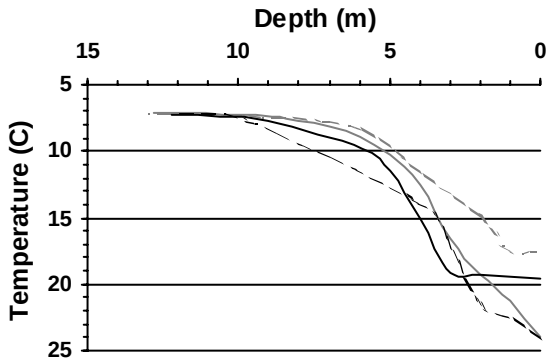
[a] 0 - value not recorded (plant may not be submersed)
1 - few plants in only 1 or a few locations
2 - few plants, but with a wide patchy distribution
3 - plants in large patches, codominant with other plants
4 - plants in nearly monospecific patches, dominant
5 - thick growth covering substrate to exclusion of other species

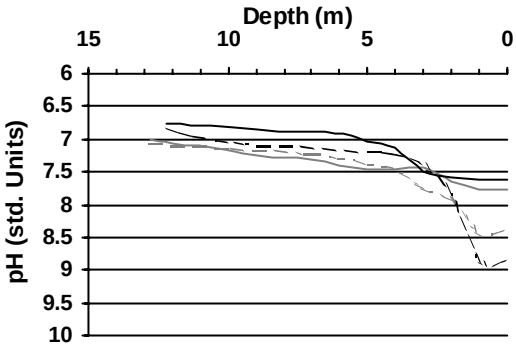
Secchi Depth and Profile Graphics

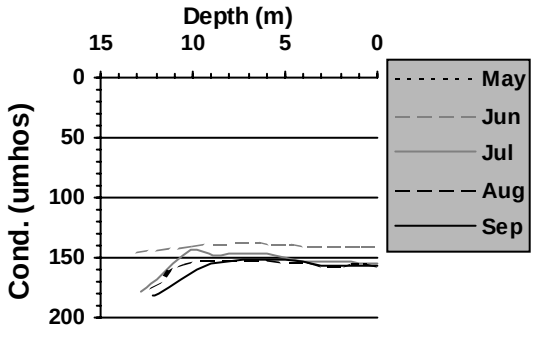
Station: 1 HARPI1











Secchi Data and Field Observations

HARTS

Date	Time	Temp-erature (F)	Secchi (ft)	Color (1-greens, 11-browns	Bright-ness (pct)	Wind (1-none, 5-gusty)	Rainfall (0-none, 5-heavy)	Aesthetics (1-bad, 5-good)	Swimming (1-poor, 5-good)	Geese (#)	Waterfowl (besides geese #)	Boats-Fishing (#)	Boats-Skiing (#)
Station 1													
6/1/1999			4.59	8	50			4	1	0	2	1	0
	Sampler: SMITH			Remarks:	More homes observed in the w-shed than in 1996. Shoreline approx. 80% naturally vegetated. Wilcox farm nearby. Manure odor. Many cattle grazing on slope near Wilcox Farm. Lots of huge Daphnia. 2 bald eagles observed--possible pair.								
6/24/1999			3.61										
	Sampler: Parsons			Remarks:									
7/10/1999			6.79	7	0	1		5	3	0	0	2	0
	Sampler: SMITH			Remarks:	Aphanizomenon bloom--large plates. H2S in hypo at 12 meters.								
8/2/1999			4.92	7	0	1	1	3	1	0	0	2	0
	Sampler: SMITH			Remarks:	One of the thickest Aphanizomenon blooms I've ever seen. Balls of algae the size of nickels. One bald eagle observed.								
9/6/1999			7.87	9	50	1	1	4	3	0	0	3	0
	Sampler: SMITH			Remarks:	Lots of users at boat launch. Heavy black discoloration in the water at 11m. Some discoloration at 8m. Fec#1 at west inlet near cow pasture. pH and conductivity measurements are qualified as estimates due to calibration failing QA/QC requirements.								